Description

Mail-processing machine

Technical Field

The invention relates to a mail-processing machine having a conveying path on which the upper reach of a circulating first conveyor, particularly a conveying chain, forms intermittently or continuously conveyed transport sections for sheet like articles and feeds to a handling station such sheet like articles or sets thereof having been placed into said transport sections.

Related Art

In said handling station, a manipulator hand may be movable, by means of a manipulator drive, over a base plate in a direction perpendicular to the conveying direction of the first conveyor, sheet like articles or sets thereof fed onto the base plate by the conveyor being moved by the manipulator hand, particularly by means of conveying fingers articulated on the manipulator hand, into a first processing arrangement, which is located alongside the base plate. The manipulator fingers can be raised, for a return stroke, and lowered, for an operating stroke, in relation to the base plate by means of an actuating arrangement.

Mail-processing machines of this type having as a handling station an envelope-filling station or inserter, wherein manipulator fingers push the sheet like articles or sets thereof , which are pushed onto the base plate of the insertion station by the conveyor, into the openings of envelopes, which are provided in the abovementioned first processing arrangement in synchronism with feeding of sheet like articles or sets of sheet like articles and in synchronism with the operation of the inserter, are well known in the art.

It is also known for sheet like articles or sets thereof fed onto the base plate of an inserter station by a first conveying chain, to be allowed to advance up of an

inserter station by a first conveying chain, to be allowed to advance up against an optionally lowerable or raisable stop on that side of the base plate of the inserter station which is remote from said first conveying chain and, either for said sheet like articles or sets thereof to be pushed, by the manipulator fingers of the operative inserter station, into envelopes provided alongside the base plate, in the first processing arrangement, or, e.g. if the inserter arrangement of the handling station should be inoperative, for the abovementioned stop to be raised and said sheet like articles or sets thereof to be conveyed further from the base plate, by conveying means, in continuation of the direction in which they have been conveyed up by the first conveying chain. Such sheet like articles or sets thereof conveyed further may then be fed to separate processing in downstream stations and pushed into different envelopes, for example, in another inserter station.

Summary and Objects of the Invention

The object of the present invention is to configure a mail-processing machine of the general type defined in the introduction, such that, even in the case of spatial restrictions at the set-up location, a variety of processing steps can be performed and easy changeover to different processing tasks is achieved.

The object is achieved according to the invention by the features of claim 1.

Advantageous configurations, developments and modifications form the subject matter of the claims which follow claim 1 and, without the wording of these claims being specifically repeated here, reference is taken expressly to the subject matter of these claims.

A mail-processing machine of the type specified here thus contains, at the end or along the route of a first conveying path, a handling station, from the base plate of which sheet like articles or sets thereof fed thereto by the first conveying chain, can be passed on, perpendicularly to the conveying direction of the first conveying path, optionally to one side or to the other side, to a first processing arrangement or to a second processing arrangement.

These processing arrangements, in turn, either may serve for inserting the sheet material or sets thereof into envelopes or may, in turn, contain conveying chains, that is to say a second conveying chain and a third conveying chain for example, which for their part, lead the sheet like articles or sets thereof through further processing stations.

According to a very advantageous feature of one embodiment, such conveying chains, as well as the first-mentioned conveying chain, can be reversed, as a result of which the handling station of the mail-processing machine specified here, in conjunction with the reversible conveying chains, becomes a crossover junction with essentially any selectable direction of flow of sheet like articles, or sets thereof, desired.

Brief Description of the Drawings

Exemplary embodiments are explained in more detail hereinbelow with reference to the drawing, in which:

Fig. 1 shows a schematic perspective view of the handling station and conveying paths and/or conveying chains, interacting therewith, of a mail-processing machine of the type specified here, and

Fig. 2 shows a schematic side view of the manipulator station and associated conveying paths and/or conveying chains according to Fig. 1, as seen in the direction in which the sheet like articles or sets thereof are fed by a first conveying chain.

Detailed Description of a Preferred Embodiment

In the drawings, mutually corresponding parts are defined by the same reference numerals. For illustrative reasons, certain geometrical dimensional relationships which are necessary for certain movement sequences, and result for example in certain operation-stroke ranges, are not included in the drawings, since

these geometrical relationships will be easily and clearly discernible from the following description as far as the person skilled in the art is concerned or are known in any case to the person skilled in the art. The illustration thus concentrates on demonstrating the working principle.

The mail-processing machine specified here contains a conveying path **1** with a, for example, continuously circulating endless conveying chain on which there are arranged conveying fingers **2** which project up beyond the surface of the conveying path **1** when they are moved, in a conveying direction, with the upper reach of the conveying chain and dropped beneath the surface of the conveying path **1** when they move with the lower reach of the conveying chain, as is known in general for conveying chains of this type. Groups or pairs of conveying fingers located one beside the other in the conveying direction form transport sections into which sheet like articles or sets thereof are introduced or deposited in operating stations lined up along the conveying path, these operating stations not being shown in the drawing. It is to be understood that guide means are provided laterally along the conveying path, and are intended for bounding the transportation sections laterally, said guide means having been left out in order to simplify the illustration.

In the case of the exemplary embodiment shown, the conveying chain to which there are connected the conveying fingers **2**, is driven continuously, and the transportation sections defined by consecutive conveying fingers **2** pass on the sheet like articles or sets thereof which have been introduced therein to an intermittently driven conveying chain. The conveying fingers **3** of the intermittently driven conveying chain, as they move with the upper reach of said intermittently driven conveying chain, project up beyond the surface of the conveying path **1** at a greater lateral spacing than the conveying fingers **2**, and drop beneath the level of the conveying path **1** in order then to be moved back with the lower reach of the intermittently operated conveying chain. The conveying direction of the continuously operated conveying chain, which has the conveying fingers **2**, and of the intermittently operated conveying chain, which has the conveying fingers **3**, is clearly shown by the arrow **F** in Fig. 1. It can be seen from Fig. 1 that, for

illustrative reasons, the longitudinal extent of the active conveying path of the intermittently operated conveying chain has been represented vastly shortened.

The sheet like articles or sets thereof which have been introduced into the transportation sections of the continuously operated conveying chain are transferred to the transportation sections of the intermittently operated conveying chain such that during the continuous advancement of a sheet like article or of a set thereof by a pair of conveying fingers **2**, before the latter have dropped beneath the level of the conveying path, a pair of conveying fingers **3** of the intermittently driven conveying chain, downstream of the pair of conveying fingers **2** in the conveying direction, rise up above the level of the conveying path **1** during transfer from the lower reach of said conveying chain to the upper reach thereof and, on account of the intermittently operated conveying chain having a higher drive speed in this phase than the continuously operated conveying chain, said pair of conveying fingers **3** overrides the conveying fingers **2** in the conveying direction and carry along the relevant sheet like article or the relevant set of articles, whereas the conveying fingers **2** of the previously conveying conveying-finger pair then drop beneath the surface of the conveying path **1**. The conveying fingers **3** of the intermittently operated conveying chain then push a sheet like article or a set of articles further in the conveying direction until such time as the article or the set of articles bears fully on a base plate **4** of a handling station **5**, whereupon the intermittently operated conveying chain is brought to a standstill.

The handling station **5** contains two side bearing supports **6** and **7** which project up beyond the level of the conveying path **1** and the level of the surface of the base plate **4** and are fastened, parallel to the conveying direction, on a machine framework (not shown in the drawing) at a spacing from one another which is greater than the maximum dimension, in the conveying direction of conveying path **1**, of sheet like articles or sets thereof which are to be handled. The significance of this dimensioning is discussed in more detail hereinbelow. The side bearing supports **6** and **7** project upwards, by way of vertical legs, outside the lateral boundary line of the conveying path **1**, said boundary line running in the conveying

direction corresponding to the arrow **F**, and extend, by way of the top transverse legs **8** and **9**, respectively, into a region above the base plate **4**, as can be seen from Fig. 1. Mounted in bearing bores at the free ends of the transverse legs **8** and **9** is an actuating shaft **10**, of which the geometrical axis runs parallel to the conveying direction, corresponding to the arrow **F**, above the base plate **4**. Fastened on the actuating shaft **10** is an actuating lever **11**, a manipulator hand **13** being articulated at the bottom end thereof via a bearing spindle **12**. Furthermore, an actuating link **15** is articulated on the manipulator hand **13** via a bearing shaft **14**, the top end of said actuating link being connected pivotably to a horizontal support post **16** which for its part, as is indicated at **17** in Fig. 1, is connected fixedly to the side bearing support **6**. It should be mentioned here that, on that side of the actuation link **15** which is remote from the side bearing support **6**, the bearing support post **16** essentially does not project beyond said actuating link, such that, in the case of relatively pronounced anticlockwise pivoting of the manipulator hand **13** and of the actuating lever **11** and also of the actuating link **15** in relation to the situation which is illustrated in Fig. 1 and 2, the actuating lever **11** can be moved past the point of articulation of the actuating link **15** towards the bearing support post **16**. This purpose is also served by the offset positioning, which can be seen from Fig. 1, of the articulation of the actuating lever **11** on the manipulator hand **13** in relation to the articulation of the actuating link **15** on the manipulator hand **13**.

Mounted rotatably on that side of the manipulator hand **13** which is remote from the bearing shaft **14**, at the free end of said manipulator hand, is a manipulator-finger shaft **18**, of which the geometrical axis is oriented parallel to the conveying direction, corresponding to the arrow **F**, and parallel to the geometrical axis of the actuating shaft **10**. Connected in a rotationally fixed manner to said shaft are manipulator fingers **19**, which bear pushing elements **20** at their free, bottom ends. These pushing elements are produced, at least in their bottom part, from a material with good sliding properties and high wear strength, in order to keep said pushing elements **20** sliding smoothly over the surface of the base plate **4** as they more over said surface.

It should also be mentioned here that according to a particular embodiment, which is not shown specifically here, the rotationally fixed connection of the manipulator fingers **19** to the manipulator-finger shaft **18** may have a small amount of resiliently loaded play, so as to ensure uniform bearing of all the pushing elements on the surface of the base plate **4** when the pushing elements are lowered onto the base plate in order to execute an operating stroke there. This last-mentioned design feature is known per se for an inserter machine.

Moreover, an adjusting ring **21** with a downwardly projecting lever attachment is seated in a rotationally fixed manner on the manipulator-finger shaft **18**. This lever attachment stresses a tensioning spring **23** with respect to a downwardly projecting pin **22** fastened on the manipulator hand **13**, and said tensioning spring has the effect of prestressing the manipulator-finger shaft **18**, and the manipulator fingers **19** connected thereto, in the clockwise direction in relation to the situation which is shown in the drawing.

Finally, a further adjusting ring **24** is fastened on the manipulator-finger shaft **18**, a lever attachment **25** projecting away from the said adjusting ring in a radial direction. Said lever attachment **25**, at its free end, has two axially spaced-apart guide follower rollers **26** and **27**, which are coaxial with one another.

An adjusting ring **28** is fastened on an extension of the actuation shaft **10** which projects beyond the side bearing support **6**, on a side of the latter which is remote from the side bearing support **7**, and a lever extension **29** projects away from said adjusting ring in the radial direction, the free end of this lever extension **29**, as is indicated at **30**, being connected in an articulated manner to an actuating rod **31**. The actuating rod **31** is moved upwards and downwards in synchronism with the machine cycle by a crank drive (not shown in the drawing) and thus brings about a corresponding, restricted rotation of the actuating shaft **10** in the clockwise and anticlockwise directions. This results in corresponding, restricted pivoting movements of the actuating lever **11**, with the result that the manipulator hand **13**,

which is also coupled to the bearing support post **16** by the actuating link **15**, executes movements back and forth in a region above the base plate **4**.

The length of the actuating lever **11** between the geometrical axis of the actuating shaft **10** and of the bearing shaft **12**, also the length of the actuating link **15** between the geometrical axis of the bearing support post **16** and of the bearing shaft **14**, and further the positions of the geometrical axis of the actuating shaft **10** and of the bearing support post **16** and the mutual spacings between the bearing shaft **14**, the bearing shaft **12** and the geometrical axis of the manipulator-finger shaft **18** are selected such that the manipulator-finger shaft **18** moves approximately horizontally over the surface of the base plate **4** during the pivoting movements of the actuating lever **11**, over a comparatively large distance. However, during this movement of the manipulator-finger shaft **18**, which corresponds either to an operating stroke or to a return stroke of the handling station **5**, the manipulator hand **13** is not in any way moved parallel to itself in a horizontal direction over the surface of the base plate **4**, at a spacing therefrom, but rather, during the pivoting of the actuating lever **11** about the bearing shaft **12**, executes an additional pivoting movement, initiated by the actuating link **15**, which, on account of the selected geometry of said three-link mechanism realized in the handling station **5**, results in the manipulator-finger shaft **18** remaining at an approximately constant level above the base plate **4** during its operating stroke and during the return stroke.

It can be seen from the illustrations of Fig. 1 and 2 that the design of the handling station **5**, and of the actuating elements thereof, is selected such that free through-passage-channel areas for sheet like articles or sets thereof are formed, above the base plate **4** of the handling station, not just from the conveying path **1**, or the conveying chain which contains the conveying fingers **3**, but also perpendicularly to the conveying direction corresponding to the arrow **F**, to the sides, these through-passage-channel areas being designated by **32** and **33** in Fig. 2, while the through-passage-channel area for the sheet like articles above the conveying path **1** is indicated at **34** in Fig. 2. It is only the conveying fingers of conveying chains and/or the manipulator fingers **19** which extend into these areas,

while it is not the case in any movement phase of the drive mechanism of the handling station **5** that the rest of the actuating elements or bearing parts of the latter intrude into or violate these through-passage-channel areas for the sheet like articles or sets thereof.

The two guide follower rollers **26** and **27**, which are mounted at the free end of the lever attachment of the adjusting ring **24**, which is seated on and fastened to the manipulator-finger shaft **18**, interact with their respectively associated guide rails **35** and **36**. These guide rails are each indicated by chain-dotted lines in Fig. 1. Actuating drives **37** and **38** respectively assigned to each of them adjust their position in relation to the route of the guide follower rollers **26** and **27**.

If it is intended for the handling station **5** to operate such that the pushing elements **20** of the manipulator fingers **19** are moved from right to left in an operating stroke, in which they bear on the surface of the base plate **4**, and are moved back from left to right in a return stroke, in which they have been raised off from the surface of the base plate **4**, then, for example by means of the actuating drive **38**, the guide rail **36** is moved upwards to such an extent that it does not in any operating phase come into contact with the guide follower roller **27** assigned to it, whereas the guide rail **35**, for the operating stroke of the manipulator fingers **19** and of the pushing elements **20**, is moved, by means of the actuating drive **37**, into the raised position, which is shown for example in Fig. 2, with the result that, at the beginning of the operating stroke, the guide follower roller **26** can first of all yield upwards, and the tension spring **23**, via the manipulator-finger shaft **18**, pulls the manipulator finger **19**, with the pushing elements **20** arranged thereon, downwards. At the end of the operating stroke, the guide rail **35** is then lowered, by means of the actuating drive **37**, to such an extent that the pushing elements **20** in the manipulator fingers **19** are raised and do not reach the through-passage-channel areas **32**, **34** or **33** through the entire return stroke of the handling station. Thereafter, the guide rail **35** is moved into the raised position, as shown for example in Fig. 2, again by the actuating drive **37**, in order to prepare the beginning of a new operating stroke.

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However, if it is intended for the operating stroke to begin on the left-hand side, starting from the position shown for example in Fig. 2, and to be carried out from left to right with the pushing elements **20** bearing on the surface of the base plate **4**, then the guide rail **35** is rendered inoperative by virtue of being raised, by means of the actuating drive **37**, and the actuating drive **38** moves the guide rail **36** into the position specified for example in Fig. 2. At the beginning of the stroke in this operating direction, the guide follower roller **27**, which is assigned to the guide rail **36**, can yield upwards and allow the lowering of the manipulator fingers **19**, by the action of the tension spring **23**, onto the surface of the base plate **4**. At the end of the operating stroke, which has been directed from left to right in relation to the situation in Fig. 2, the guide rail **36** is lowered, by the actuating drive **38**, to such an extent that, via the guide follower roller **27** and the lever attachment of the adjusting ring **24** as well as the manipulator-finger shaft **18**, the manipulator fingers **19** are raised off from the base plate **4** and the return stroke from right to left is initiated.

As has already been noted in a general observation in relation to the illustrations in the drawings, the actuating arrangement for the manipulator fingers **19** in the form of two guide rails which can be actuated optionally and independently of one another, and of guide follower rollers assigned thereto, is to be understood as a highly schematic illustration. Said actuating arrangement can be modified in a variety of ways. For example, it is possible for individual guide sections to be provided such that they can be adjusted separately and independently of one another along the route of a single guide follower roller, in particular since, during the operating stroke with pushing elements bearing on the surface of the base plate **4**, the guide follower rollers or a single guide follower roller are/is not in engagement with the guide rail or the guide rails anyway. In another embodiment, it is also possible to install on the manipulator hand **13** an actuating arrangement in the form of solenoid drives which are supplied with electric control signals via flexible lines from the machine framework and which actuate the manipulator shaft **18** in the desired manner such that either the operating stroke, or in another method

of operation the return stroke, is oriented from right to left in relation to the situation of Fig. 2.

In terms of the actuation of the manipulator fingers **19** via a lever attachment attached to the manipulator-finger shaft **18**, an embodiment which is not shown in the drawing but which has proven successful in practice is one in which said lever attachment is provided with just a single guide follower roller, which interacts with a single guide rail which can be adjusted by an actuating drive. This guide rail is mounted on a rocker or on a parallelogram, which can be adjusted in height in a straightforward manner by means of the actuating drive, which in the case of this embodiment assumes the function of the above-mentioned actuating drives **37** and **38**. By corresponding actuation of the actuating drive, the manipulator fingers **19**, via joint guide follower roller, the lever attachment and the manipulator-finger shaft, are lowered during the operating stroke from left to right, and are raised during the return stroke from right to left, or vice versa.

In terms of their movement direction over the base plate **4**, the pushing elements **20** at the free ends of the manipulator fingers **19** are designed in essentially the same way on the front side and rear side and are provided with recesses, with the result that they reliably grip the edges of sheet like articles or sets thereof which are to be displaced. Since the manipulator-finger shaft **18** maintains approximately the same level above the surface of the base plate **4** essentially over the entire operating stroke, the angle of the manipulator fingers **19** relative to the surface of the base plate **4** likewise remains essentially the same, although the angle between the manipulator hand **13** and the manipulator finger **19** changes. This, in turn, has the result that the pushing elements **20** also remain approximately parallel to the surface of the base plate **4** during the operating stroke and thus, irrespective of the selected operating direction of the handling station **5**, both the front side and the rear side of the pushing elements **20** can be used as that region which acts on the edges of the sheet like articles or sets thereof which are to be displaced.

It is possible to compensate slight twisting of the pushing elements **20** relative to the surface of the base plate **4** during the operating stroke if, according to one configuration, which is illustrated at **40** in Fig. 1, just in a small region around the pushing element **20** which is located furthest to the right, the pushing elements run in grooves of the base plate **4** when the manipulator fingers **19** are in the operating state of the operating stroke. These grooves extend over the entire surface of the base plate **4** in a length which exceeds the length of the operating stroke, but for greater clarity of the illustration, with the above-mentioned exception in Fig. 1, the grooves have not been depicted.

To the right-hand side and left-hand side of the conveying path **1** and of the base plate **4**, it is possible to install intermittently driven gripper chains for the purpose of feeding open envelopes to the through-passage-channel areas **32** and **33** for the sheet like articles or sets thereof. Such gripper chains then operate, in conjunction with the handling station **5**, as inserter stations, such that sheet like articles or sets thereof which are fed over the conveying path **1** can be inserted into envelopes optionally to the right of left, depending on whether the manipulator fingers **19** and the pushing elements **20** fastened thereon execute their operating stroke, in which they bear on the surface of the base plate **4**, from left to right or from right to left.

However, in the case of the embodiment shown in Fig. 1 and 2, the through-passage-channel areas **32** and **33** for the sheet like articles or sets thereof lead to further conveying paths **41** and **42**, which run transversely to the conveying path **1** and are assigned further conveying chains with conveying fingers **43** and **44** fastened thereon. These further conveying chains may be operated continuously or intermittently, whereby their circulatory speed or the operating cycle may be adapted to the operating speed or the operating cycle of the handling station **5**. At least one of the conveyer chains having respectively said conveying fingers **43** and **44** can be constructed so that it is reversible in its circulation direction. If, then, in a modified embodiment, a gripper-chain path is provided for the purpose of feeding open envelopes, instead of the conveying path which forms the opposite processing

arrangement, then sheet like articles or sets thereof which are to be inserted in envelopes, may optionally be fed from two mutually perpendicular directions, in order for such sheet like articles or sets thereof to be in each case positioned on the base plate **4** and then inserted into envelopes. For example, the sheet like articles may be fed via the conveying path **1** and the conveying path **42**, which has been reversed in terms of the chain circulation, and insertion into the envelopes takes place on a gripper-chain path installed at the location of the conveying path **41**. However, it is also possible for the arrangement to be such that the sheet like articles are fed optionally via the conveying path **1** and the conveying path **41** and insertion into the envelopes is carried out on a gripper-chain path installed at the location of the conveying path **42** instead of the conveying path **41**.

The operation of the conveying fingers **43** and **44** receiving sheet like articles or sets thereof from the pushing elements **20** in order to convey said articles or sets thereof away in the direction of the conveying paths **41** and **42**, respectively, takes place such that, upon reaching the upper reach of their conveying chain, the conveying fingers **43** and **44** rise up beyond the respective guide-path surface when the pushing elements **20** have already conveyed the respective edge of the respective article or of the respective set of articles over them.

In a further configuration, the conveying chain which is provided with the conveying fingers **3**, and is operated intermittently, may be designed such that it also extends over the base plate **4** in the conveying direction, corresponding to the arrow **F**, for which purpose the base plate is provided with corresponding slits for the through-passage of the conveying fingers **3**. These slits may continue, on the far side of the base plate **4**, in a continuing conveying path **45**, this making it possible for sheet like articles or sets thereof to be conveyed rectilinearly beyond the conveying path **1** without being processed in the handling station **5**, and to be fed to processing stations which are lined up along the continuing conveying path **45**. If this method or operation is selected, then the actuation arrangement for the manipulator-finger shaft **18** is switched such that the manipulator fingers **19** are

raised off from the base plate 4 both during the displacement of the manipulator hand 13 in one direction and during the return displacement.